Nutritional and Phytochemical Analysis of Wild Leafy Vegetable *Hibiscus sabdariffa* L. (Ambadi Bhaji) Used By the Tribes of Bhiwapur Tehsil Nagpur District, India

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Abstract:

Background: Wild edible plants play an important role in human life and are the vital constituent of the traditional diet. People of the Bhiwapur tehsil are very close to the nature, wild edible plants like *Hibiscus sabdariffa* aerial parts (Ambadi Bhaji), which is one of the natural resources in the tehsil. They have the direct dependence on the wild plants for their sustenance. Due to the easy accessibility, these vegetables are very commonly utilized by the tribes and the travelers. **Objectives:** The present investigation aimed to assess the nutritional and phytochemical analysis of aerial parts of ambadi bhaji. **Methods:** The study includes the estimation of Ash content, protein, carbohydrate (sugar), fats, energy, crude fiber and mineral contents (Cu, Fe, Mn, Zn, Ca, Na, K). The water extract was screened for the qualitative phytochemical analysis. **Results:** Ambadi Bhaji was found the rich source of carbohydrate (9.2 and 13.45 g/100g), fiber (2.3 and 3.76g/100g) and energy (52.7 and 70.86 Kcal and/100g).

Keywords: *Hibiscus sabdariffa*, Bhiwapur, nutritional, phytochemical, tribal.

Introduction:

The evidence of man's dependency on plants for his survival can be demonstrated by palaeo-ethnobotanical findings from prehistoric archaeological sites [Renfrew, 1963 with 1986]. In many tropical countries rural people traditionally harvest wide range of leaf of vegetables, roots, tubers and fruits because of its cultural uses, as a food supplement labelled as 'famine' or 'hunger' food. Plants not only provide the edible fruits but also have their importance in providing fodder, fuel and medicines. They play a significant role in the food and nutrient security of rural poor tribal's. Gathering of wild vegetables and fruits is a common practice even today. These are often and the only vegetables consumed, as tribal cannot afford cultivated commercial fruits, vegetables etc. The wild edible species are mostly gathered by the tribal, rural communities and forest dwellers for consumption value to fulfill their daily requirement and taste during festivals. The general information, edibility and therapeutic properties of these wild vegetables and tubers, their safety data and nutritional composition are in negligence [Aloskar, et al. 1992].

Some wild vegetables have been identified to have better nutritional value than the one that are cultivated [Eromosele et al. 1991; Maikhiri et al. 1994]. As a result, in recent years, a growing interest has emerged to evaluate various wild edible plants for their nutritional features. (Nazarudeen, 2010; Aberoumand and Deokule, 2009). By taking into consideration present study was designed to evaluate the nutritional and phytochemical traits of aerial parts Hibiscus sabdariffa (Ambadi Bhaji) from Bhiwapur Tahsil.

Material and Methods:

It is mainly found in the Tropical and Sub-Tropical regions of the world. The composition of leaf is comparable to other dark green leafy vegetables. It produces a bast fiber similar to the jute but with a greater tensile strength. No anti- nutritional compound has been reported. It is an annual herb 2-5mm tall, tap root system is well developed, stem is erect slender, cylindrical. Leaves alternate, simple, stipulate, filiform, 5-8mm long, pubescent, petiole 3-30cm long, blade palmately, dentate margin. Flowers axillary, solitary or in clusters near the apex of the plant, bisexual, pentamerous, pedicel 2-6mm long, epicalyx long persistent, calyx companulate, persistent, green, bristly. Stamens numerous with yellow or red anthers. Ovary superior. Fruits ovoid, capsule. Seeds triangular. Hibiscus sabdariffa can be easily distinguished by the white arachnoid tomentum on the calyx.

Study area of vegetable collection

The study area is situated between the 20^0 35' and 21^0 44' N latitudes and between 75^0 53, and 80^0 East longitudes and is spread over the area of 61323.62 hectares of land. It includes 106 villages with a tribal population of 83,164 (2001). The tribal communities that fall in the villages are Banjara, Gond, Mana, Dhivar and Pardhi, of which Gond tribes are dominant. The vegetation is of deciduous type with a rainfall in average 45 inches [Nagpur, 2014].

Field survey, collection of leafy vegetable, and its related data, were carried out during the period of April 2011 to 2013, in different seasons. The specimens were identified by carefully matching them in the herbarium and authentically certified, by the Department of Botany Hislop College, Nagpur (Specimen no. 6821). Ethnic informers were consumed to locate and collect the plant along with the other informants. Useful information was gathered by interviewing the local people and elderly persons. Narurally growing wild leafy vegetables of Ambadi bhaji were collected from the study area. The green fresh leaves were collected shade dried; pulverized and coarse powder was utilized for their phytochemical and nutritional analysis.

Mineral contents : To prepare the sample for mineral analysis, the leaves of ambadi bhaji were oven dried, pulverized to fine powder and used for dried ashing.The powdered leaves were taken in a pre-cleaned and constantly weighed silica crucible and heated in a muffle furnace at 450°C till there was no evolution of smoke. The crucible was cooled at room temperature in a desiccator and carbon-free ash was moistened with concentrated sulphuric acid and heated on a heating mantle till fumes of sulphuric acid ceased to evolve. The crucible with suphated ash was then heated in a muffle furnace at 600°C till the weight of the content was constant (~2–3 h). One gram of sulphated ash obtained above was dissolved in 100 ml of 5% HCl to obtain the solution ready for determination of mineral elements through atomic absorption spectroscopy (AAS) (Figure 3) and flame photometry (FPM). Standard solution of each element was prepared and calibration curves were drawn for each element using AAS/FPM [Janani and Sondhi, 1995].

Moisture content

The green leaves of ambadi bhaji were cut into small pieces and moisture content was examined by air oven method at 105°C and till to get the constant weight. The loss in weight was regarded as a measure of moisture content [Anonymous, 1999].

Ash content : For determination of ash content, 10 g of dried powdered sample was weighed in a quartz crucible. The crucible was heated first over a low flame till all the material was completely charred, followed by heating in a muffle furnace for about 3–5 h at 600 °C. It was cooled in a desiccator and weighed to ensure completion of ashing. To ensure completion of ashing, it was heated again in the furnace for half an hour, cooled and weighed. This was repeated consequently till the weight became constant (ash became white or grayish white). Weight of ash gave the ash content [Anonymous, 1999].

Fat content : Fat content was determined by extracting 2 g dried sample with petrol in a Soxhlet extractor, heating the flask on a heating mentle for about 6 h till a drop taken from the drippings left no greasy stain on the filter paper. After boiling with petrol, the residual petrol was filtered using Whatman no. 40 filter paper and the filtrate was evaporated in a pre-weighed beaker. Increase in weight of beaker gave crude fat [Chopra and Kanwar, 1991] (Figure 3).

Protein content : The protein was determined using micro Kjeldahl method. Two grams of oven-dried material was taken in a Kjeldahl flask and 30 ml conc. H_2SO_4 was added followed by the addition of 10 g potassium sulphate and 1 g copper sulphate. The mixture was heated first gently and then strongly once the frothing had ceased. When the solution became colourless or clear, it was heated for another hour, allowed to cool, diluted with distilled water and transferred to 800 ml Kjeldahl flask, washing the digestion flask. Three or four pieces of granulated zinc, and 100 ml of 40 % caustic soda were added and the flask was connected with the splash heads of the distillation apparatus. Next 25 ml of 0.1 N sulphuric acid was taken in the receiving flask and distilled. When two-thirds of the liquid had been distilled, it was tested for completion of reaction. The flask was removed and titrated against 0.1 N caustic soda solution using methyl red indicator for determination of Kjeldahl nitrogen, which in turn gave the protein content [Indrayan et al., 2005] (Figure 4).

Fiber content: The crude fiber content was determined to be reported along with the nutritive value. For determination of crude fibre, the estimation was based on treating the moisture and fat-free material with 1.25 % dilute acid, then with 1.25 % alkali, thus imitating the gastric and intestinal action in the process of digestion. Then 2 g of moisture and fat-free material was treated with 200 ml of 1.25 % H_2SO_4. After filtration and washing, the residue was treated with 1.25 % NaOH. It was the filtered, washed with hot water and then 1 % HNO_3 and again with hot water. The residue was ignited and the ash weighed. Loss in weight gave the weight of crude fibre [Chopra and Kanwar, 1991].

Percentage carbohydrate was given by: 100 – (percentage of ash + percentage of moisture + percentage of fat + percentage of protein) [Indrayan et al., 2005].

Nutritive value was finally determined by: Nutritive value = 4 ´ percentage of protein + 9 ´ percentage of fat + 4 ´ percentage of carbohydrate [Indrayan et al., 2005].

Extraction and phytochemical screening

The decoction of dried coarse powder was prepared at 80 °C for about 2 h and lyophilized to get the dried water extract. The extract was screened for the presence of different primary and secondary metabolite using different phytochemical tests [Khandelwal, 2001].

Result and Discussion:

Nutritional analysis: The importance and awareness of nutrition is public health issues, has resulted in the increase demand of knowledge of the biochemical nutrients of foods. Carbohydrates and sugars highly contribute for energy (9.2 and 13.45g/100g), energy (52.7 and70.86 Kcal and/100g) and fiber (2.3 and 3.76g/100g) signify the role of wild edible leaves of ambadi bhaji as good source of nutrition. About 14 elements are essential to human health, deficiency of which create health problem. Human bodies daily need more than 100 mg of major minerals (N, P, K, Ca, Mg, Na) and less than 100 mg of minor minerals (Cu, Fe, Zn, Mn, Co, Br, Si) [Rajangam et al. 2001; Aslam et al. 2005].The processing methods produce Na and K ratio less than 1 which is in accordance with the recommended ratio [Angela et al. 2010]. As per the results of mineral analysis, the Na/K found 0.012 which is within the recommended ratio for good human health generator inside the cells of human body. The other important minerals (Cu,Fe.Mn,Zn,Ca,Na,K) were found in the range of 1.29±0.01 to 15.82±0.02 (Table 1). Excessive ratio of zinc to copper (>16) from dietary sources causes imbalance in their bioavailability and has been linked to increased risk of cardiovascular disorders [Ma and Netts, 2000]. The less Zn/Cu ratio (12.26) in Bael fruit may contribute its several therapeutic applications. The nutritional analysis revealed that the vegetable is not only acting as supplementary food but is the tonic requirement of the tribal's, and deprived of poor Bhiwapur. The aerial parts of Ambadi Bhaji found to contain carbohydrates, proteins, sterols, glycosides, saponins, polyphenols and flavonoids.

Table. 1- Nutritional analysis of Ambadi Bhaji .

Nutritional Characteristics (DW)	Result
Total ash (g/100g)	2.63±0.07
Moisture (g/100g)	58.95±0.12
Protein (g/100g)	6.91±0.11
Fat (g/100g)	1.70±0.17
Fibre (g/100g)	7.26±0.23
Sugar (g/100g)	6.38±0.09
Carbohydrate including sugar (g/100g)	22.55±0.15
Copper (mg/100g)	1.29±0.01
Iron (mg/100g)	3.32±0.03
Manganese (mg/100g)	1.53±0.03
Zinc (mg/100g)	15.82±0.02
Calcium (mg/100g)	86.69±0.01
Sodium (g/100g)	0.02±0.07
Potassium (mg/100g)	1.66±0.09
Calorific value (Kcal/100g)	133.14

Each value represents the mean ± SD of three determinations (n = 3) on dried weight of fruit pulp (DW) basis.

Table. 2- Preliminary phytochemical analysis of Suran Kand water extract

Phytoconstituents	Test	Observations	Aqueous extract
Alkaloids	Dragendroff's	Orange colour ppt produced	+
Alkaloids	Mayer's Test	Cream coloured ppt produced	+
Alkaloids	Wagner's test	Reddish brown colour ppt produced	+
Flavonoids		Magenta (brick) red colour produced	+
Proteins	Biuret test	Violet or purple colour produced	+
Proteins	Millon's test	Red colour produced	+
Carbohydrates	Molisch's test	Red or dull violet colour produced	+
Carbohydrates	Fehling's test	Yellow or red colour ppt produced	+
Phytosterols	Liebermann-Burchard test	Dark red or pink colour produced	+
Glycosides	Baljet test	Yellow to orange colour produced	+
Glycosides	Keller-Killiani test	Two layer reddish brown colour produced, in upper layer turns bluish green colour produced	+
Phenols	Ferric chloride test	Deep blue or black colour produced	+
Saponins	Foam test	Persistent form produced	+

Where (+) and (-) indicate the presence and absence of phyto-constituents respectively.

Figure. 1- *Hibiscus sabdariffa* L. aerial parts

Conclusion:

The result highlighted significance of wild leafy vegetable as a cheap source of nutrient for the rural and tribal people. It brings into focus the rich nutritional composition of the wild plants and the scope for their use as an alternative source of bio-nutrition. The mineral analysis indicated the scope of using wild edible vegetables for dietary supplement. It has valuable ingredients as micro-minerals

(Fe, Cu, Zn and Mn) and macro-minerals (Ca, Na and K). Many other wild edible plants therefore need to be analyzed which could help in selecting promissory species for inclusion in agro and farm-forestry and re-forestation programs. Plantation of wild edible plants helps to sustain the wild animals. There is a need to explore more wild edible plants that will add new dimensions towards traditional management and conservation of plant wealth.

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